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HANDLING ORDER (PROXY) BIDS IN AN ON-LINE AUCTION

REFERENCE TO PROVISIONAL APPLICATION

This application claims the benefit of the filing date of corresponding U.S. Provisional Patent Application No. 60/185,401, entitled "Handling Order (Proxy) Bids in an On-Line Auction", filed February 28, 2000.

BACKGROUND OF THE INVENTION

1. Technical Field:

The present invention relates generally to an improved data processing system, and in particular to a method and apparatus for handling order bids in an on-line auction. Still more particularly, the present invention provides a method and apparatus for setting bids for bidding agents in an on-line auction.

2. Description of Related Art:

The Internet, also referred to as an "internetwork", is a set of computer networks, possibly dissimilar, joined together by means of gateways that handle data transfer and the conversion of messages from the sending network to the protocols used by the receiving network (with packets if necessary). When capitalized, the term "Internet" refers to the collection of networks and gateways that use the TCP/IP suite of protocols.

The Internet has become a cultural fixture as a source of both information and entertainment. Many businesses are creating Internet sites as an integral part

of their marketing efforts, informing consumers of the products or services offered by the business or providing other information seeking to engender brand loyalty. Many federal, state, and local government agencies are also employing Internet sites for informational purposes, particularly agencies which must interact with virtually all segments of society such as the Internal Revenue Service and secretaries of state. Providing informational guides and/or searchable databases of online public records may reduce operating costs. Further, the Internet is becoming increasingly popular as a medium for commercial transactions.

Currently, the most commonly employed method of transferring data over the Internet is to employ the World Wide Web environment, also called simply "the Web". Other Internet resources exist for transferring information, such as File Transfer Protocol (FTP) and Gopher, but have not achieved the popularity of the Web. In the Web environment, servers and clients effect data transaction using the Hypertext Transfer Protocol (HTTP), a known protocol for handling the transfer of various data files (e.g., text, still graphic images, audio, motion video, etc.). The information in various data files is formatted for presentation to a user by a standard page description language, the Hypertext Markup Language (HTML). In addition to basic presentation formatting, HTML allows developers to specify "links" to other Web resources identified by a Uniform Resource Locator (URL). A URL is a special syntax identifier defining a communications path to specific information. The URL provides a universal, consistent method for finding and accessing this information, not necessarily for the user,

but mostly for the user's Web "browser". A browser is a program capable of submitting a request for information identified by an identifier, such as, for example, a URL. A user may enter a domain name through a graphical user interface (GUI) for the browser to access a source of content. The domain name is automatically converted to the Internet Protocol (IP) address by a domain name server (DNS), which is a service that translates the symbolic name entered by the user into an IP address by looking up the domain name in a database.

The Internet also is widely used to transfer applications to users using browsers. With respect to commerce on the Web, individual consumers and business use the Web to purchase various goods and services. In offering goods and services, some companies offer goods and services solely on the Web while others use the Web to extend their reach.

Auctions or brokered sales are another form of business activity on the Internet. These auctions are similar to those in real world auctions. As with real world auctions, some buyers may not have sufficient time to participate in an Internet or on-line auction. In such a case, a proxy or bidding agent may be used to submit bids on behalf of the buyer and in the best interest of the buyer. Further, Internet auctions often run for periods of time longer than real world auctions. In this situation, having bidding agents to provide proxy or order bid services for a buyer is equally important in Internet auctions.

One problem occurring with the use of bidding agents in Internet auctions is a situation in which two or more bidding agents enter a bidding war submitting a sequence

of bids with each bid beating a prior bid by the minimum bid increment. This behavior causes a very large number of bids to be submitted, which in turn causes the bid tables to become excessively large. This situation places a strain on system resources as well as an inconvenience to other buyers who have to scan through a large number of bids.

Therefore, it would be advantageous to have an improved method and apparatus for providing bidding agents which do not generate large numbers of bids.

SUMMARY OF THE INVENTION

The present invention provides a method and apparatus for generating bids for bidding agents in an auction. Bids are sorted by decreasing bid amount for regular bids and upper limit for order bids to form a sorted set of bids, wherein each bid includes a quantity and wherein the bids include order bids. A first bid is identified requesting a quantity in which an unallocatable portion is present. A number of order bids is selected from the bids, wherein the number of order bids are higher in the sorted set of bids than the first bid and have an allocation requirement less than the unallocatable portion of the of the first bid. A price is set for all order bids higher than the first bid in the sorted set but not in the aforementioned selected number of order bids.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

Figure 1 depicts a pictorial representation of a distributed data processing system in which the present invention may be implemented;

Figure 2 is a block diagram of a data processing system that may be implemented as a server in accordance with a preferred embodiment of the present invention;

Figure 3 is a diagram illustrating components used in an Internet auction in accordance with a preferred embodiment of the present invention;

Figure 4 is a diagram illustrating a process for setting prices for order bids in accordance with a preferred embodiment of the present invention;

Figure 5 is a diagram illustrating data structures used to process bids in accordance with a preferred embodiment of the present invention;

Figure 6 is a flowchart of a process used for allocating quantities to bids in accordance with a preferred embodiment of the present invention;

Figure 7 is a flowchart of a process used for pricing order bids in accordance with a preferred embodiment of the present invention; and

Figure 8 is a diagram illustrating a code segment for processing order bids in accordance with a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference now to the figures, **Figure 1** depicts a pictorial representation of a distributed data processing system in which the present invention may be implemented. Distributed data processing system **100** is a network of computers in which the present invention may be implemented. Distributed data processing system **100** contains a network **102**, which is the medium used to provide communications links between various devices and computers connected together within distributed data processing system **100**. Network **102** may include permanent connections, such as wire or fiber optic cables, or temporary connections made through telephone connections.

In the depicted example, a server **104** is connected to network **102** along with storage unit **106**. In addition, clients **108**, **110**, and **112** also are connected to network **102**. These clients **108**, **110**, and **112** may be, for example, personal computers or network computers. For purposes of this application, a network computer is any computer, coupled to a network, which receives a program or other application from another computer coupled to the network. In the depicted example, server **104** provides data, such as boot files, operating system images, and applications to clients **108-112**. Clients **108**, **110**, and **112** are clients to server **104**. In these particular examples, server **104** may host an on-line auction. Clients **108**, **110**, and **112** may receive information on items that are to be auctioned and submit bids for those items.

Distributed data processing system **100** may include additional servers, clients, and other devices not shown.

In the depicted example, distributed data processing system **100** is the Internet with network **102** representing a worldwide collection of networks and gateways that use the TCP/IP suite of protocols to communicate with one another. At the heart of the Internet is a backbone of high-speed data communication lines between major nodes or host computers, consisting of thousands of commercial, government, educational and other computer systems that route data and messages. Of course, distributed data processing system **100** also may be implemented as a number of different types of networks, such as for example, an intranet, a local area network (LAN), or a wide area network (WAN). **Figure 1** is intended as an example, and not as an architectural limitation for the present invention.

Referring to **Figure 2**, a block diagram of a data processing system that may be implemented as a server, such as server **104** in **Figure 1**, is depicted in accordance with a preferred embodiment of the present invention. Server **200** may be a symmetric multiprocessor (SMP) system including a plurality of processors **202** and **204** connected to system bus **206**. Alternatively, a single processor system may be employed. Also connected to system bus **206** is memory controller/cache **208**, which provides an interface to local memory **209**. I/O bus bridge **210** is connected to system bus **206** and provides an interface to I/O bus **212**. Memory controller/cache **208** and I/O bus bridge **210** may be integrated as depicted.

Peripheral component interconnect (PCI) bus bridge **214** connected to I/O bus **212** provides an interface to PCI local bus **216**. A number of modems may be connected to PCI bus **216**. Typical PCI bus implementations will support

four PCI expansion slots or add-in connectors. Communications links to network computers **108-112** in **Figure 1** may be provided through modem **218** and network adapter **220** connected to PCI local bus **216** through add-in boards.

Additional PCI bus bridges **222** and **224** provide interfaces for additional PCI buses **226** and **228**, from which additional modems or network adapters may be supported. In this manner, server **200** allows connections to multiple network computers. A memory-mapped graphics adapter **230** and hard disk **232** may also be connected to I/O bus **212** as depicted, either directly or indirectly.

Those of ordinary skill in the art will appreciate that the hardware depicted in **Figure 2** may vary. For example, other peripheral devices, such as optical disk drives and the like, also may be used in addition to or in place of the hardware depicted. The depicted example is not meant to imply architectural limitations with respect to the present invention.

The data processing system depicted in **Figure 2** may be, for example, an IBM RISC/System 6000 system, a product of International Business Machines Corporation in Armonk, New York, running the Advanced Interactive Executive (AIX) operating system.

Turning next to **Figure 3**, a diagram illustrating components used in an Internet auction is depicted in accordance with a preferred embodiment of the present invention. In this example, server **300** hosts auction services, which may be accessed across Internet **302**. For example, a buyer or user located on web browser **304** in client **306**. Through web browser **304**, the buyer may

receive information on items being auctioned on server **300** as well as submit bids for those items. In this example, server **300** includes a secure web server **308**, which is used to receive and process requests for information and bids. In this example, secure web server **308** uses various known encryption techniques to provide privacy and security for buyers submitting bids. Secure web server **308** sends received requests to appropriate components, such as registration **310**, catalog **312**, bid engine **314**, and order bid engine **316** for processing. Additionally, secure web server **308** will receive results and format those results for return to the originator of the requests. In these examples, the requests are received in an HTTP format and placed in the appropriate form for use by other components in server **300**. Further, secure web server **308** will reformat the responses from these components into the appropriate form for return to the requestor.

Registration **310** is used to identify and register buyers who participate in the auctions. Catalog **312** in these examples are used to provide information, such as identification of items being auctioned as well as quantities of these items and descriptions of the items. Bid engine **314** provides bid handling processes to analyze received bids, identify winners of auctions, and set prices for the items. Bid engine **314** may handle a single auction or many auctions.

In the depicted examples, order bid engine **316** contains the processes of the present invention used to provide order bid services. Order bid engine **316** may contain a number of bidding agents used to provide these services for buyers who are unable to participate in the

auction.

The components shown in **Figure 3** are for illustrative purposes and not meant as limitations to the implementation of the present invention. Other components may be used in addition to or in place of the illustrated components for providing auction services. For example, client **306** may be a pervasive/mobile device accessing auction functions using WAP protocol through WAP gateways.

The present invention provides a method, apparatus, and computer implemented instructions for providing order bid services. The mechanism of the present invention calculates a final equilibrium position that would be reached by bidding agents if they were to engage in a bidding war. A bid is submitted for each bidding agent at this equilibrium position. This mechanism eliminates the occurrence of large sequences of bids at small or minimal increments being generated by bidding agents. As used herein, a bidding agent is a program or other computer implemented process used to generate bids on behalf of a buyer.

Turning next to **Figure 4**, a diagram illustrating a process for setting prices for order bids is depicted in accordance with a preferred embodiment of the present invention. Stack **400** contains bids **b1**, **b2**, **b3**, and **bx**. In this auction, the quantity **Q** represents the total quantity of items available in the auction. The quantity **qx** represents a shortfall in the items. In this example, bid **bx** cannot be fully allocated because the available quantity **Q** has a shortfall **qx**. In setting prices paid by order bids, order bids are priced above the bid **bx** such that the unpriced quantity is less than the shortfall **qx**.

In this example, the order bids in **S1** are **b1**, **b2**, and

b3. Of course, in other cases bids **b1** and **b2** may not be order bids. Also, the process of the present invention may work with any number of bids. The four bids shown are only for purposes of illustration. These order bids have to collectively bid enough to dislodge the bid **bx**. In stack **400**, the shortfall **qx** is greater than zero. A subset **S"1** is selected from **S1** as shown in stack **402**. In this example, subset **S"1** contains the order bid **b3**. For purposes of illustration, only a single order bid is illustrated, but subset **S"1** may contain multiple order bids. The selection criteria for bids in subset **S"1** are numerous. For example, these bids may be selected based on the time when a bid is received or posted, on the upper limit of the order bid, or as a subset of bids, which minimize revenue that is lost. The upper limit for an order bid is the highest price that will be bid for an item. Another selection criteria may be for bids, which accept partial allocations. A bid, which accepts a partial allocation, is one that requests a set quantity, but will accept a lesser quantity. The order bids in subset **S'1** are governed or set based on order bid **bx**. The quantity **q'x** for order bid **b3** is less than the shortfall. These positions or groupings of bids form a final equilibrium position from which pricing of bids may occur.

This process may be repeated for any remaining order bids or any remaining quantity. In this example, the remaining quantity is **qx** minus **q'x**. This process provides a realistic bidding mechanism for bidding agents. A real buyer would bid less than the bid provided by bid **bx** if the buyer knew that the quantity requested by bid **bx** could not be fulfilled by the available quantities left after the other bids have been taken into account.

Turning next to **Figure 5**, a diagram illustrating data structures used to process bids is depicted in accordance with a preferred embodiment of the present invention. Allocation list **500** is a data structure containing all bids received, both order bids and non-order bids. The bids are organized in allocation list **500** by decreasing per unit bid. In other words, these bids are placed from highest amount to lowest amount on a per item or unit basis. Order bids are placed into allocation list **500** based on the upper limit for an order bid.

Allocation list **500** is scanned sequentially from the highest to lowest to allocate quantities to these bids. In some cases, a bid may not be fully allocated. In this situation the shortfall is used to price order bids. An order bid is placed into pricing list **502** when the order bid is to be allocated some quantity. The ordering of bids within pricing list **502** may be based on different policies. For example, the order of bids may be based on the time when an order bid is received or posted or on the upper limit of an order bid. Order bids within pricing list **502** have been allocated a quantity, but do not yet have a bid value at this point. Allocation list **500** and pricing list **502** are data structures, which may take various forms, such as, for example, a table, a linked list, or a database.

Using pricing list **502**, a set of order bids within pricing list **502** is identified for which the total quantity requested or demanded is less than a shortfall for a particular bid within allocation list **500**. All remaining bids within pricing list **502** are priced to beat the price for this particular bid unless the prices for

these bids already beat the particular bid. If this particular bid is an order bid, then the upper limit of this order bid has to be beaten.

Turning next to **Figure 6**, a flowchart of a process used for allocating quantities to bids is depicted in accordance with a preferred embodiment of the present invention. This process is implemented in a order bid engine, such as order bid engine **316** in **Figure 3** in these examples.

The process begins by collecting all bids present and placing the bids in a list of bids (step **600**). In this example, the bids present are all of the bids that have been posted to the server at the time this process is initiated. In this example, the list of bids takes the form of a data structure, such as allocation list **500** in **Figure 5**. A price list is initialized to NULL (step **602**). In other words, the price list is empty at this point. In this example, the price list may be implemented using pricing list **502** in **Figure 5**. A pointer A is initialized to point to the top of the list of bids (step **604**). The quantity available is then identified (step **606**). The bids in the list of bids are sorted by decreasing per unit bid (step **608**).

A determination is made as to whether the quantity requested by a bid can be fully allocated (step **610**). If the quantity requested can be fully allocated, then the allocation requested is given (step **612**). Next, the quantity available is then decremented (step **614**). The quantity decremented is based on the amount allocated in step **614**. A determination is made as to whether the bid is an ordered bid (step **616**). If the bid is an ordered

bid, the bid is placed on a price list (step **618**). Pointer A is then moved to the next bid on the list of bids (step **620**). Thereafter, a determination is made as to whether the end of the list has been reached (step **622**). If the end of the list has not been reached, the process determines whether some unallocated items or unpriced order bids are present in the price list (step **624**). If either of the two checks are true, the process returns to step **610**. If both statements are false, the algorithm terminates.

If the end of the list has been reached in step **622**, a subset of bids in the price list is found in which the quantity demanded is less than the shortfall (step **626**). Next, the identified bids are priced (step **628**). These bids are then removed from the price list (step **630**) with the process terminating thereafter.

With reference again to step **610**, if the quantity requested cannot be fully allocated or the bid is not a partial bid, the shortfall in the quantity is calculated (step **632**). In step **632**, the shortfall calculation is as follows: if the bid is a partial bid, the shortfall is 2; else the shortfall is the difference between the quantity demanded and the quantity available. Next, a determination is made as to whether the bid is a partial bid and some items are unallocated (step **634**). If this determination is true, the bid receives whatever quantity is available (step **636**), and the available quantity is decremented to zero (step **638**). Then, a subset of bids in the price list is identified in which the quantity demanded by these bids is less than the shortfall (step **640**). The identified bids are skipped and the remaining

bids are priced (step **642**). These bids that have been priced are then removed from the price list (step **644**). The process then returns to step **616**.

With reference again to step **634**, if a partial bid is not present or some items or no items are unallocated, the process proceeds directly to step **640** as described above.

Turning next to **Figure 7**, a flowchart of a process used for pricing order bids is depicted in accordance with a preferred embodiment of the present invention. This process is used to price order bids that have been placed into a price list, such as the one described in step **618** in **Figure 6** above.

First, a determination is made as to whether a displaced bid is present i.e., there is a bid which did not receive full allocation (step **700**). A displaced bid is a bid corresponding to an order bid that has lost its ranking order because of a new bid in the system. If a displaced bid is present, then the tentative price for bid is set equal to the displaced bid (step **702**). Next, a determination is made as to whether the tentative price is greater than the current bid (step **704**). The current bid is the price that is currently set for a bid on a per item basis in these examples. If the tentative price is greater than the current bid, the current bid is set equal to the tentative price plus an increment (step **706**) with the process terminating thereafter. This increment may be set a number of different ways. For example, one could have an increment requirement as 5 above the current lowest winning bid, if the current lowest winning bid is between 5 and 500, and 50 above the current lowest winning bid if the current lowest winning bid is between 500 and

50,000. The increment may be a fixed number defined by the auction rules, or a function of the tentative bid.

With reference again to step **704**, if the tentative price is not greater than the current bid, the process terminates. Turning back to step **700**, if a displaced bid is not present, a determination is made as to whether the minimum bid is greater than the current bid (step **708**). The minimum bid is the minimum amount required to be bid for an item. If the minimum bid is greater than the current bid, the current bid is set equal to the minimum bid (step **710**) with the process terminating thereafter. The process terminates in step **708** if the minimum bid is not greater than the current bid.

Turning next to **Figure 8**, a diagram illustrating a code segment for processing order bids is depicted in accordance with a preferred embodiment of the present invention. Code **800** illustrates code used to allocate quantities of items to bids. This code implements the process illustrated in **Figure 6** above.

The processes used to allocate quantities and provide pricing may be executed at different times. For example, these processes may be executed periodically or after a selected number of bids have been received. Additionally, these processes may be run based on an estimate of the mid-point of an auction at a time before the auction closes. In such a case, the process is run when the estimated mid-point of the auction occurs. Alternatively, these processes could be run at some percentage or time period prior to when the auction is estimated or scheduled to close.

Thus, the present invention provides an improved method, apparatus, and computer implemented instructions

for handling order bids in an on-line auction, such as those that occur on the Internet. The mechanism of the present invention eliminates situations in which a bidding war occurs between two or more bidding agents in which a sequence of bids are submitted with each bid beating a prior bid by the minimum bid increment. By eliminating this situation, the amount of system resources required to run an on-line auction and the inconvenience to bidders caused by having to review large numbers of bids is reduced. This advantage is provided, in the examples, through estimating or determining the final equilibrium position between bidding agents if such a bidding war were to occur. Then, a bid is submitted for each of the bidding agents based on this final equilibrium position.

It is important to note that while the present invention has been described in the context of a fully functioning data processing system, those of ordinary skill in the art will appreciate that the processes of the present invention are capable of being distributed in the form of a computer readable medium of instructions and a variety of forms and that the present invention applies equally regardless of the particular type of signal bearing media actually used to carry out the distribution. Examples of computer readable media include recordable-type media, such as a floppy disk, a hard disk drive, a RAM, CD-ROMs, DVD-ROMs, and transmission-type media, such as digital and analog communications links, wired or wireless communications links using transmission forms, such as, for example, radio frequency and light wave transmissions. The computer readable media may take the form of coded formats that are decoded for actual use in a particular

data processing system.

The description of the present invention has been presented for purposes of illustration and description, and is not intended to be exhaustive or limited to the invention in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art. For example, although the system is illustrated with respect to auctions on the Internet, these processes may be applied to other types of auctions, such as those on an intranet or on a local area network. The embodiment was chosen and described in order to best explain the principles of the invention, the practical application, and to enable others of ordinary skill in the art to understand the invention for various embodiments with various modifications as are suited to the particular use contemplated.